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2. Patent application number
(The Patent Office will fill in his part) — 0316348.2 — 11 JUL 2003

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation

Glaxo Group Limited
Glaxo Wellcome House, Berkeley Avenue,
Greenford, Middlesex UB6 0NN, Great Britain

473587003

United Kingdom

4. Title of the invention — A Dispenser

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent
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Corporate Intellectual Property

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Corporate Intellectual Property (CN9 25.1)
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8072555006

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Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

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12. Name and daytime telephone number of person to contact in the United Kingdom: J N Rice 01279 644508

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A DISPENSER

Related Applications

The present application is related to the UK patent applications filed concurrently herewith by the Applicant (Glaxo Group Limited) under the title 'A Dispenser' and with Applicant's references PB60389P-A, PB60389P-B and PB60389P-D. The contents of these applications are hereby incorporated herein by reference.

Field of the Invention

The present invention relates to a dispenser for dispensing unit products, for instance pills, such as pharmaceutical pills. The term "pill" is meant to embrace tablets, capsules and the like, and other solid oral dosage forms, whether pharmaceutical or otherwise.

Summary of the Invention

According to the present invention there is provided a dispenser according to claim 1 hereof.

Other aspects and preferred features of the invention are set out in the other claims (including those in the related applications referred to above) and in the exemplary embodiment hereinafter to be

described with reference to the accompanying FIGURES of drawings.

Brief Description of the FIGURES of Drawings

FIGURE 1 shows a standard container for containing and dispensing pharmaceutical pills comprising a bottle and a lid.

FIGURE 2 shows a hand-held dispenser for pharmaceutical pills according to an embodiment of the present invention comprising the bottle and the lid of FIGURE 1 and a dispensing module, the dispensing module being mounted on the bottle and the lid being mounted on the dispensing module.

FIGURE 3 shows the dispenser without the lid.

FIGURES 4A and B are side views of the dispensing module.

~~FIGURE 5 is an exploded view of the dispensing~~ module.

FIGURES 6A-C are perspective end views of the dispensing module showing how a battery can be replaced.

FIGURES 7A-E are longitudinal sectional views of the dispensing module illustrating its operation to

dispense a pill therefrom and showing the internal channel structure of the module.

FIGURES 8A and B are schematic views of the channel structure in the dispensing module.

FIGURES 9A-C are schematic views illustrating the dispensing of a pill from the dispensing module.

FIGURES 10-C correspond to FIGURES 9A-C, but show the inclusion of switches to control operation of an electronic dose counter of the dispensing module.

FIGURE 11 shows the dispenser being pressed against a user's palm to "blot" out a pill therefrom.

FIGURE 12 shows a display of the electronic dose counter illustrating the segmented nature thereof.

Detailed Description of the FIGURES of Drawings

In the FIGURES of drawings there is shown a hand-held dispenser 1 of the invention for dispensing pills 3, in this embodiment pharmaceutical pills. The dispenser has a container or bottle 100, a lid 200 and a dispensing module 300 releasably mountable on the bottle 100.

Referring to FIGURE 1, the bottle 100 in this embodiment is of standard pill bottle construction, having a hollow body 101 which is formed with a base

103, on which the dispenser 1, when assembled, is able to stand upright, and a neck 105, through which an access opening 107 is provided to the internal volume of the body 101 in which the pills 3 are contained. The access opening 107 is sized so as to enable the pills 3 to be tipped out of the bottle 100 when oriented upside down.

The body 101 is preferably formed from a plastics material or glass. The plastics material may be a polyethylene, for instance low density polyethylene (LDPE), or polypropylene (PP), for example.

The neck 105 has an outer circumferential surface 109 on which is provided a screw thread profile 111.

The lid 200, which is preferably of a plastics material, has an annular skirt 201 which depends from an end wall 203. The annular skirt 201 has an inner circumferential surface on which is provided a screw thread profile (not shown) which is complementary to the screw thread profile 111 on the bottle neck 105. In this way, the lid 200 is able to be screwed onto the bottle neck 105 to sealingly close the access opening 107. Preferably, the screw fitting between the bottle 100 and the lid 200 is of a child-resistant nature, i.e. a force additional to turning is needed to remove the lid 200 from the bottle 100. As examples, there may be mentioned "squeeze-and-turn" and "push-and-turn" closures.

Of course, other types of co-operable connection structures on the bottle 100 and lid 200 could be used, again preferably being of a child-resistant type, namely requiring two different types of force to be applied for removal of the lid 200 from the bottle 100.

As shown in FIGURES 2-7, the dispensing module 300 has a hollow body 301, which is preferably of a plastics material, having a lower end 303 and an upper end 305. The body 301 has an internal cavity 307 to which there is provided a lower opening 309 in the lower end 303, and an upper opening 311 in the upper end 305.

The lower end 303 defines an annular skirt 313 about the lower opening 309 having an inner circumferential surface 315 on which is provided a first screw thread profile 317 complementary to the screw thread profile 111 on the bottle neck 105. Thus, the dispensing module 300 is able to be screw mounted onto the bottle neck 105, in similar fashion to the lid 200. The first screw thread profile 317 may form a child-resistant connection with the bottle neck screw thread profile 111, and is conveniently identical to the lid screw thread profile.

At the module upper end 305 there is located a nozzle 319 of tubular form having a lumen 321 which defines the upper opening 311. The nozzle 319 is arranged for sliding movement in the dispensing module

300 along its longitudinal axis. A spring or other biasing mechanism 320 (see FIGURE 5) is provided to bias the nozzle 319 outwardly to a rest position, as shown in FIGURES 2-4, for example.

The nozzle 319 has an outer circumferential surface 323 on which is provided a second screw thread profile 325 of the dispensing module 300. The second screw thread profile 325 is complementary to the lid screw thread profile thereby enabling the lid 200 to be screwed onto the nozzle 319 when in its rest position to close the upper opening 311, as shown in FIGURE 2. Moreover, when the lid 200 is mounted on the nozzle 319, the nozzle 319 is unable to be slid inwardly from its rest position through abutment of the lid skirt 201 with an annular shoulder 327 of the dispensing module body 301.

Again, the second screw thread profile 325 preferably co-operates with the lid screw thread profile to form a child-resistant connection. Conveniently, the second screw thread profile 325 is identical to the screw thread profile 111 on the bottle neck 105.

It will therefore be seen that the dispenser 1 enables the lid 200 to be replaced on the bottle 100 by the dispensing module 300 and then in turn mounted on the nozzle 319 to close the upper opening 311 of the module 300 (the "assembled state"). Thus, the dispensing module 300 can be mounted on a standard

pill bottle and be closed by the lid for the standard bottle. This is shown in FIGURE 2.

As shown in FIGURES 6-8, the module internal cavity 307 has a funnel-like configuration, having a cylindrical entrance 329 at the lower opening 309, with tapered sides 330, and a generally rectangular slot 331, which extends towards the upper opening 311 through the lumen 321 of the nozzle 319.

As shown in FIGURES 7 and 8, the slot 331 has a lower section 332 of a first width w1, which is greater than the diameter pd of the pills 3, and an upper section 334 of a second width w2 less than the first width w1, but greater than the pill diameter pd, but less than twice the pill diameter pd. The upper slot section 334 is offset to the lower slot section 332. Moreover, the lower slot section 332 has a base surface 336 which tapers in the upward direction.

When the dispenser 1 is inverted in its assembled state, the pills 3 are gravity fed from the bottle 100 into the dispensing module 300 through the communicating access and lower openings 107,309. The pills 3 so transferred into the dispensing module 300 are funnelled firstly by the tapered sides 330 into the lower slot section 332. In this regard, the tapered sides 330 act to funnel the pills 3 into the slot 331 in the same predetermined orientation. In this embodiment, the pills 3 are circular and funnelled into the slot 331 in a radial orientation so

that they are arranged circumference-to-circumference in the slot 331.

The pills are then gravity fed into the upper slot section 334 by the tapered base surface 336 of the lower slot section 332. In this way, a single-line queue 333 of pills 3 is formed in the upper slot section 334, as shown in FIGURE 7, for example.

Preferably, the lower and upper slot sections 332,334 have dimensions relative to the pills 3 as shown in FIGURES 8A-B. That is to say, the lower slot section 332 preferably has a depth d1 from its entrance to the side edge of the tapered base surface 336 which is greater than 1.5 times the pill diameter pd. Furthermore, the upper slot section 334 preferably has a depth d2 which is less than the pill diameter pd, but greater than the pill width pw. This enables dispensing of the pills 3 to occur while preventing or inhibiting the pills jamming and disabling operation. It allows pills 3 already in the dispensing module 300 to move down the slot 331 even when pills 3 are blocking the entrance 329.

As will now be described with reference to FIGURES 7, 9 and 10, the dispensing module 300 has a dispensing mechanism 350 which is actuable to dispense one pill 3 from the upper opening 311 per actuation. In this embodiment, the nozzle 319 forms the actuator of the dispensing mechanism 350. The dispensing mechanism 350 further has a gate 351 comprising a

movable part 353 carried by the lumen 321 of the nozzle 319, and a stationary part 355 in front of the slot 331.

The movable part 353 comprises a first switch member 357 on a first side of the nozzle lumen 321, and a guide member 359 on the opposite side of the nozzle lumen 321. The first switch member 357 is arranged so as to slide over the outer surface of the upper slot section 334 when the nozzle is depressed, whereas the guide member 359 is arranged so as to slide inside the upper slot section 334.

The first switch member 357 has a resilient arm 358 which is biased to an outboard rest state. This is the open state of the first switch member 357. The guide member 359, on the other hand, has a curved guide surface 360 which, in the rest position of the nozzle 319, forms an extension of a side wall 340 of the upper slot section 334 at the outlet end thereof.

As shown in FIGURE 7E, for example, the stationary part 355 comprises a side extension 361 of the upper slot section 334 and a finger 363 which extends from the side extension 361 transversely to the slot axis and which is spaced from the outlet end of the upper slot section 334 by a distance at least equal to the pill diameter pd. Moreover, the finger 363 is offset to the slot axis on the same side of the axis as the first switch member 357.

When the nozzle 319 is in its outboard, rest position, the movable and stationary parts 353,355 co-operate to form a barrier across the upper opening 311, i.e. the gate 351 is closed. This is shown in FIGURES 7A, 9A and 10A. More particularly, the guide surface 360 ends adjacent the finger 363 on one side thereof, and the switch arm 358 is in its rest state disposed adjacent the finger 363 on the other side.

As mentioned previously, when the dispenser 1 is inverted, a queue 333 of pills 3 forms in the slot 331. As will be appreciated from FIGURES 7A, 9A and 10A, the pill 3 at the front of the queue (hereinafter the "leading pill") passes out of the slot 331 and slides down the guide surface 360 and comes to rest on the finger 363 and against the switch arm 358. The other pills 3 in the queue 333 are stacked-up behind the leading pill offset thereto.

As shown in FIGURES 7, 9 and 10, in order to dispense the leading pill 3 of the queue 333 from the dispenser 1, the nozzle 319 is depressed inwardly. This results in the switch and guide members 357,359 moving inwardly. As the first switch member 357 moves inwardly, the switch arm 358 closes through its interaction with the leading pill 3. In this relation, the guide surface 360 may have a camming action which pushes the leading pill 3 sideways against the switch arm 358. Eventually, a gap 367 is formed between the first switch member 357 and the finger 363 large enough for the leading pill 3 to fall

out of the nozzle 319 (see FIGURES 7E, 9C and 10C). In other words, the gate 351 has been opened.

As shown in FIGURE 11, a pill 3 can be dispensed in this manner by a user pushing the nozzle 319 into their palm. Such action causes the leading pill 3 to be "blotted" out of the dispenser 1 into the palm as the nozzle 319 is slid inwardly from its rest position to actuate the dispensing mechanism 350. This action is natural and a logical progression from the tipping out of pills from a conventional pill bottle.

As further shown in FIGURES 7D, 7E, 9C and 10C, inward movement of the nozzle 319 not only causes the leading pill 3 to be dispensed, but causes the guide member 359 to push the remaining pills 3 in the queue 333 inwardly as well. This action helps to free pills 3 which would otherwise jam the dispensing module 300.

Return of the nozzle 319 to its rest position closes the gate 351 in preparation for the next dispensing cycle.

It will therefore be understood that the dispenser 1 has a dispensing mechanism 350 which operates to dose one pill 3 from the dispenser 1 per actuation.

From FIGURE 5 it will be seen that the dispensing module 300 is formed from an assembly of component parts, predominantly of a plastic material. More

particularly, the module 300 has an outer casing 370, which provides the first screw thread profile 317, an inner insert 375, which co-operates with the outer casing 370 to define the funnel-like channel configuration, an outer insert 380 which presents the nozzle 319 and is slidably mountable in the outer casing 370 for sliding movement relative to the inner insert 375, and a collar 385 fixable to the outer casing 370 which presents an aperture 387 behind which the electronic display 401 is disposed.

As shown in FIGURES 2-6 and 11, the dispensing module 300 is further provided with an electronic dose counter 400, having a circular electronic visual display 401, preferably a liquid crystal display (LCD), on which is numerically displayed the number of pills 3 contained in the dispenser 1. After each dispensing cycle, the counter 400 decrements the number displayed on the display 401 by one.

The electronic counter 400 is powered by a battery 402, e.g. a 3 volt CR2016 lithium cell or similar capacity variant, and has a printed circuit board (PCB) 403 on which is mounted a microcontroller (not shown), e.g. an Epson S1C60N16, and other appropriate electronic componentry, as will be understood by the skilled person in the art. The microcontroller is programmed to control the number displayed on the display 401, and in this connection may be connected to the display 401 through an elastomer, such as a flexible heat-seal connector.

Moreover, the microcontroller is electrically connected to the first switch member 357 forming part of the gate 351 and also to a second switch member 367 carried by the nozzle 319 (FIGURES 10A-C).

Thus, the microcontroller receives a first electrical input signal when the resilient arm 358 of the first switch member 357 is closed as it interacts with the leading pill 3 as the nozzle 319 is depressed. In other words, the first input signal is indicative that a pill 3 has passed the first switch member 357 and has been dispensed. Alternatively, the first switch member 357 may be configured such that it is closed, and hence produces the first input signal, when the gate 351 is closed. For instance, by the leading pill 3 bearing against the switch arm 358 when the dispenser 1 is inverted.

The second switch member 367 also has a resilient arm 369. The resilient arm 369 of the second switch member 367 is biased to an open position, but when the nozzle 319 is actuated it abuts an internal surface 371 of the nozzle 319 (FIGURES 10A-C) causing it to close. This results in a second electrical input signal being received by the microcontroller, which signal is representative of the nozzle 319 have been depressed a sufficient amount to effect dispensing (i.e. actuated).

Thus, the microcontroller receives two input signals, each independently indicating dispensing.

Both signals are required to be received by the microcontroller for it to act to decrement the number on the display 401. This is because the first input signal indicates the presence of a pill 3 (the leading pill) at the gate 351 due to its dependence on a pill triggering the first switch member 357, while the second input signal represents full travel of the nozzle 319 which should ensure dispensing of the pill 3 detected by the first switch member 357. This provides a fail-safe mode of counting.

When the dispenser 1 is first used, the microcontroller is programmed to display the "label claim" of pills contained therein. This may be a factory setting, or set by the prescribing medical practitioner or pharmacist. Each time the dispenser 1 is actuated, and the microcontroller receives the two input signals, which may be required to be simultaneously received or, more likely, sequentially (i.e. the first switch member 357 re-opens before the second switch member 367 closes), perhaps within a specified time period, it operates to cause the electronic display to decrement the number displayed by one. There may also be a requirement that both switches 357,367 need to be re-opened for the microcontroller to update the display 401. That is to say, the microcontroller is programmed or configured such that it will only operate to decrement the count when the two input signals are not only received, but switched-off by the switches re-opening. This adds a further fail-safe.

Of course, the dispenser 1 could be operated with just one of the switch members 357,367. For instance, as represented in FIGURE 7, only the first switch member 357 may be included in the dispenser 1.

Eventually, the display 401 will record that no pills 3 are left. In this regard, the microcontroller may be programmed to cause the display 401 to flash when the number of pills left is at or below a predetermined threshold to warn the user that a new supply of pills is, or will shortly be, needed. As an example, the microcontroller may operate to cause the display to flash the number displayed. The display 401 may flash when the number displayed is zero.

In addition to the counter function, the microcontroller and electronic display are also operatively connected such that a 'time since last dose' function is displayed by the display 401. This is particularly useful when the pills 3 are pharmaceutical pills.

As shown in FIGURE 4A, about the circumference 407 of the display 401 there is provided a scale 409 representing the time since a pill was last dispensed, in this instance each section between the adjacent indicia 411 of the scale 409 representing six hour periods, although, of course, other time periods could be represented.

After the microcontroller registers the dispensing of a pill 3 through triggering of the first and second switches 357,367, a timer in the microcontroller is activated and at predetermined intervals thereafter discrete time segments 413 are displayed on the display 401 adjacent the scale 409. In this embodiment each time segment 413 represents two hour periods, although again other time periods could be represented. Thus, after two hours from last dispensing, a first time segment 413 is displayed in the first section of the scale. This is repeated after each further two hour period until another pill is dispensed to re-set the 'time since last dose' function. Preferably, as each new time segment 413 is displayed, the previous time segments 413 remain resulting in a time segment chain being formed.

The user of the dispenser 1 will know the dosing regime for the pills 3 (i.e. the time interval between pill taking), either from the prescribing medical practitioner, pharmacist or information leaflet packed with the dispenser 1, and is provided with a visible indication of the time left till the next pill dose is needed, or of the lateness of the next dose. Thus, the dispenser 1 aids in compliance of the user in following the prescribed dosing regime. If need be, the microcontroller can be pre-programmed to cause the display to flash when the time since the last dose corresponds to the prescribed dosing regime, e.g. by flashing the time segments and/or the number of pills left.

A preferred display 401 for the dispenser 1 is shown in FIGURE 12. As will be seen, the display 401 is a segmented display, having a plurality of independently activatable segments, including the circumferentially-arranged time segments 413 for the 'time since last dose' function. In addition, the display 401 has a pair of seven-segment number-forming display sections 415.

FIGURES 6A-C show the sequence of steps for removing the battery 402 from the dispensing module 300 for replacement with a new battery. More particularly, the battery is held in a battery holder 425 having a recess 427 for accommodating the battery 402. The battery holder 425 is slidably mounted into a slot 429 formed in the tapered side 330 in the cylindrical entrance 329 at the lower module opening 309. To this end, the battery holder 402 has a tapered surface 431 so that, when slid into the slot 429, it sits flush with the tapered side 330. To remove the battery holder 425 to replace the battery 402, a screw driver or other like implement is used to lever the battery holder 425 out of the slot 429.

By enabling the battery 402 to be replaced enables the dispensing module 300 to be re-usable. Nonetheless, the dispensing module 300 may be configured such that the battery 402 is not able to be removed, e.g. in the event the module 300 is designed

to be a single-use component which is to be disposed of after use.

For tamper-proofing of the dispenser 1, a label 500 can be wrapped around the dispenser 1 so as to cover the bottle and the dispensing module 300, as shown in FIGURE 2. As will be appreciated, if the bottle 100 and dispensing module 300 are disconnected this will damage the label 500 since this bridges the joint between the bottle 100 and the dispensing module 300. This is particularly advantageous where the dispensing module 300 has a re-set button or the like for re-setting the dose counter back to the "label claim" which is only accessible when the module 300 is free of the bottle 100.

It will appreciated that the invention is not limited to the exemplary embodiment herein described with reference to the accompanying FIGURES of drawings, but may be modified, varied and adopt other guises within the scope of the appended claims.

CLAIMS

1. A hand-held dispenser for dispensing a multiplicity of unit products having a storage area for storing the unit products, an outlet opening through which the unit products are dispensable from the dispenser, a dispensing mechanism actuable to dispense the unit products through the outlet opening, and a dispensing indicator for indicating the number of unit products left in, or dispensed from, the dispenser, the dispensing indicator being integrated with the dispenser such that it is automatically updated in response to the dispensing of the unit products therefrom.

2. The dispenser of claim 1 in which the dispensing indicator has a display to indicate the number of unit products left or dispensed.

3. The dispenser of claim 2 in which the dispensing indicator is adapted to represent the number of unit products left or remaining in graphical form on the display.

4. The dispenser of claim 3 in which the number of unit products is represented with numerical indicia.

5. The dispenser of any one of claims 2-4 in which the display is an electronic display.

6. The dispenser of any one of the preceding claims wherein the dispensing indicator is an electronic indicator.

7. The dispenser of any one of the preceding claims in which the dispensing indicator is a dispensing counter.

8. The dispenser of any one of the preceding claims wherein the dispensing indicator is operatively coupled to the dispensing mechanism such that the indicator is updated in response to actuation of the dispensing mechanism.

9. The dispenser of claim 8 in which the dispensing indicator is operatively coupled to the dispensing mechanism through a detector which is adapted to detect actuation of the dispensing mechanism.

10. The dispenser of any one of the preceding claims wherein the dispensing mechanism is operatively coupled to a detector, which is adapted to detect dispensing of unit products from the outlet opening, such that the dispensing indicator is updated in response to detection by the detector of dispensing of unit products from the outlet opening.

11. The dispenser of claim 9 or 10 when appended directly or indirectly to claim 5 wherein the dispensing indicator has an electrical control circuit

for controlling the display and the detector(s) is a trigger(s) for the circuit.

12. The dispenser of claim 11 wherein the trigger(s) is a switch operable to trigger the circuit.

13. The dispenser of claim 12 when appended to claim 9 wherein the dispensing mechanism is adapted to operate the switch when actuated.

14. The dispenser of claim 12 when appended to claim 10 wherein the switch is positioned so as to be operated by the unit product(s).

15. The dispenser of any one of the preceding claims having the unit products.

16. The dispenser of claim 15 wherein the unit products are pharmaceutical products.

17. The dispenser of claim 16 wherein the pharmaceutical products are oral dosage forms.

18. The dispenser of claim 15, 16 or 17 wherein the unit products are pills.

19. The dispenser of any one of the preceding claims in which the dispensing mechanism is adapted to dispense a predetermined number of unit products per actuation.

20. The dispenser of claim 19 wherein the predetermined number is one.

21. The dispenser of any one of the preceding claims wherein the storage area is provided in a first dispenser part and the dispensing indicator and outlet opening are provided in a second dispenser part attached to the first dispenser part.

22. The dispenser of claim 21 wherein the dispensing mechanism is provided in the second dispenser part.

23. The dispenser of claim 21 or 22 wherein the first and second dispenser parts are releasably attached.

24. The dispenser of claim 21, 22 or 23 wherein the first dispenser part has an access opening through which the unit products are transferable from the storage area into the second dispenser part and the dispenser has a closure which is selectively connectable with the first and second dispenser parts to respectively close the access opening and the outlet opening.

25. The dispenser of claim 24 wherein the closure is a cap.

26. The dispenser of claim 24 or 25 wherein the closure, on the one hand, and the first and second dispenser parts, on the other hand, have co-operable connecting structures for selectively connecting the closure to the first and second dispenser parts.

27. The dispenser of claim 26 wherein the connecting structures on the first and second dispenser parts are the same.

28. The dispenser of claim 26 or 27 wherein the second dispenser part has a further connecting structure which is co-operable with the connecting structure of the first dispenser part which co-operates with the connecting structure of the closure to enable connection of the first and second dispenser parts.

29. A dispensing module for attachment to a container for a multiplicity of unit products in the form of the second dispenser part of claim 22 or any one of claims 23-28 when appended to claim 22.

30. A hand-held dispenser for dispensing a multiplicity of unit products substantially as hereinbefore described with reference to, and illustrated by, FIGURES 2-12 of the accompanying drawings.

31. A dispensing module for attachment to a container for a multiplicity of unit products

substantially as hereinbefore described with reference to, and illustrated by, FIGURES 2-12 of the accompanying drawings.

A DISPENSER

Abstract

A hand-held dispenser (1) for dispensing a multiplicity of unit products (3) having a storage area (100) for storing the unit products, an outlet opening (311) through which the unit products are dispensable from the dispenser, a dispensing mechanism (350) actuable to dispense the unit products through the outlet opening, and a dispensing indicator (400) for indicating the number of unit products left in, or dispensed from, the dispenser. The dispensing indicator is integrated with the dispenser such that it is automatically updated in response to the dispensing of the unit products therefrom.

(FIG. 3)

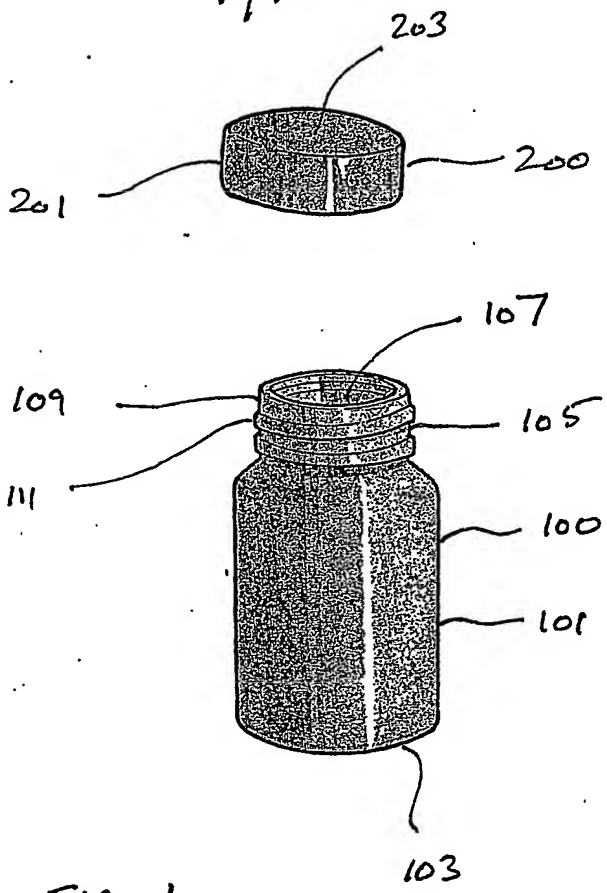

FIG. 1

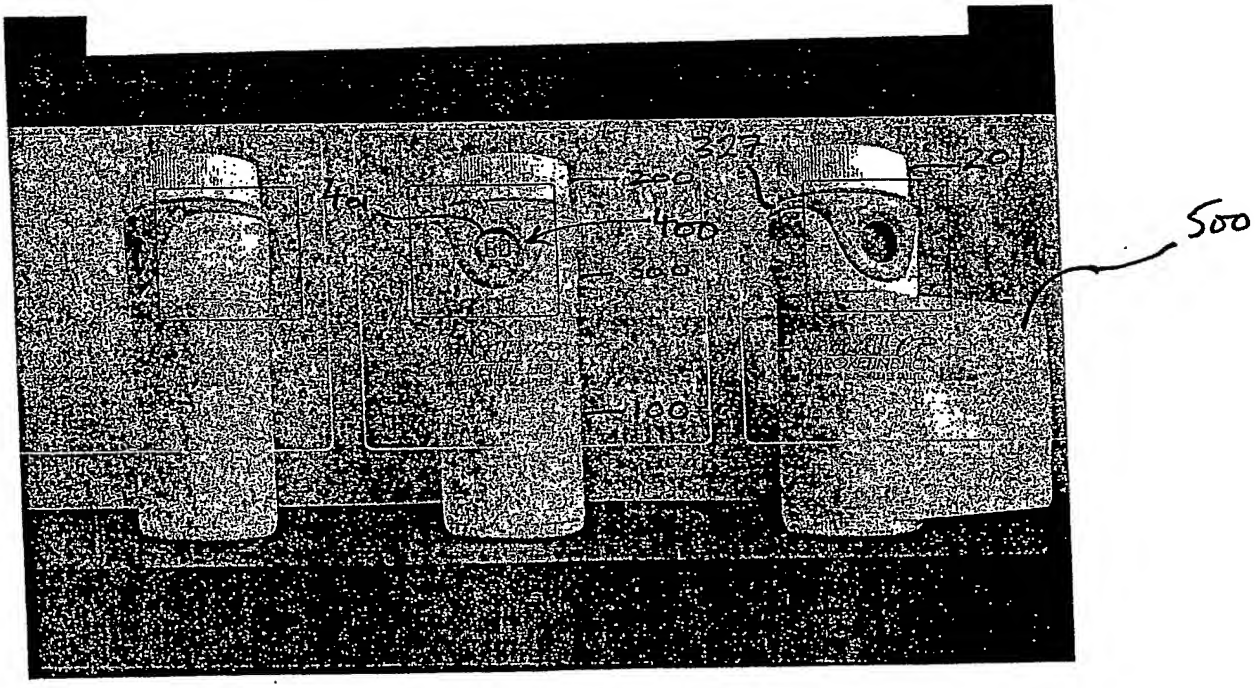

FIG. 2

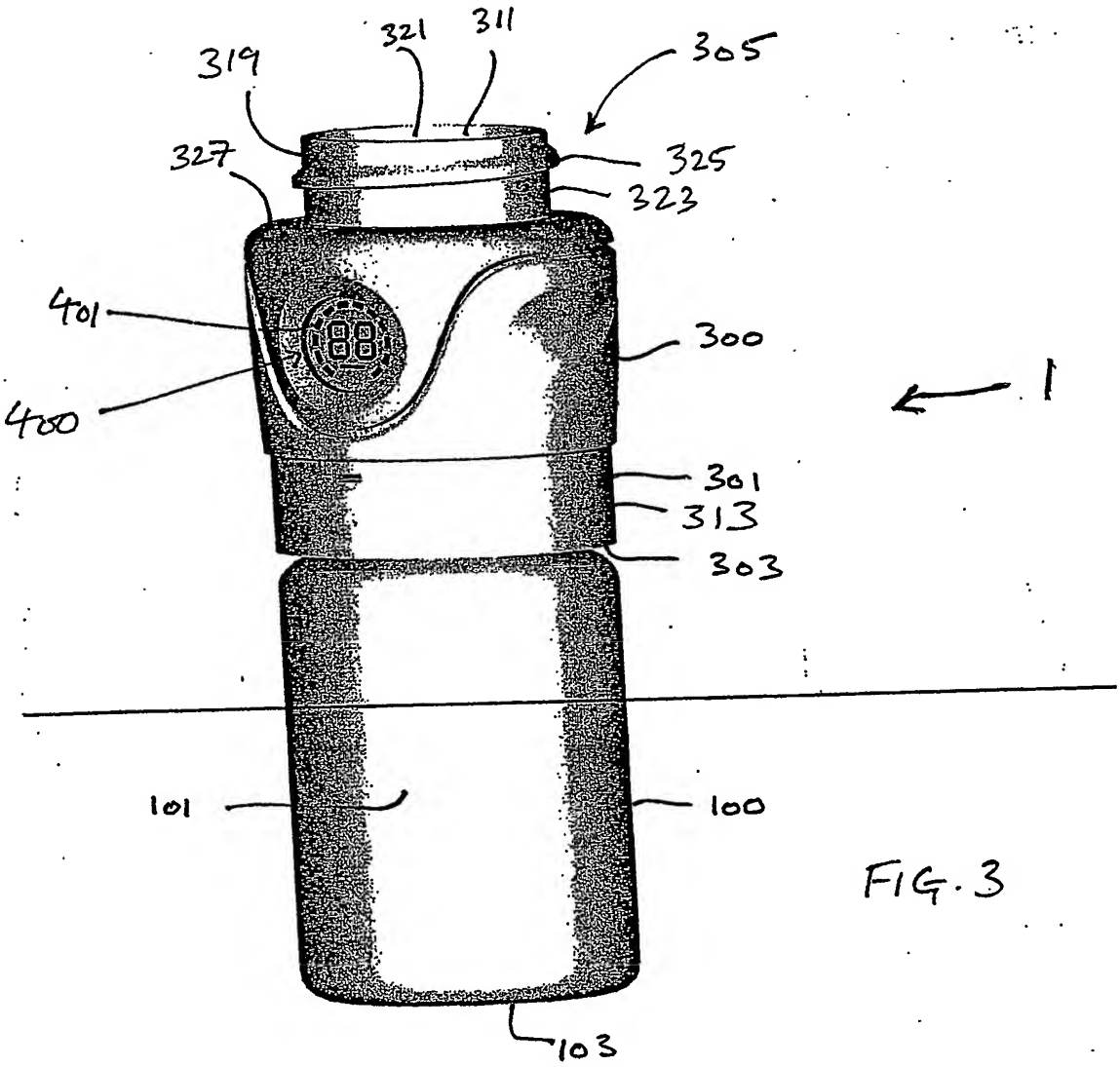

FIG. 3

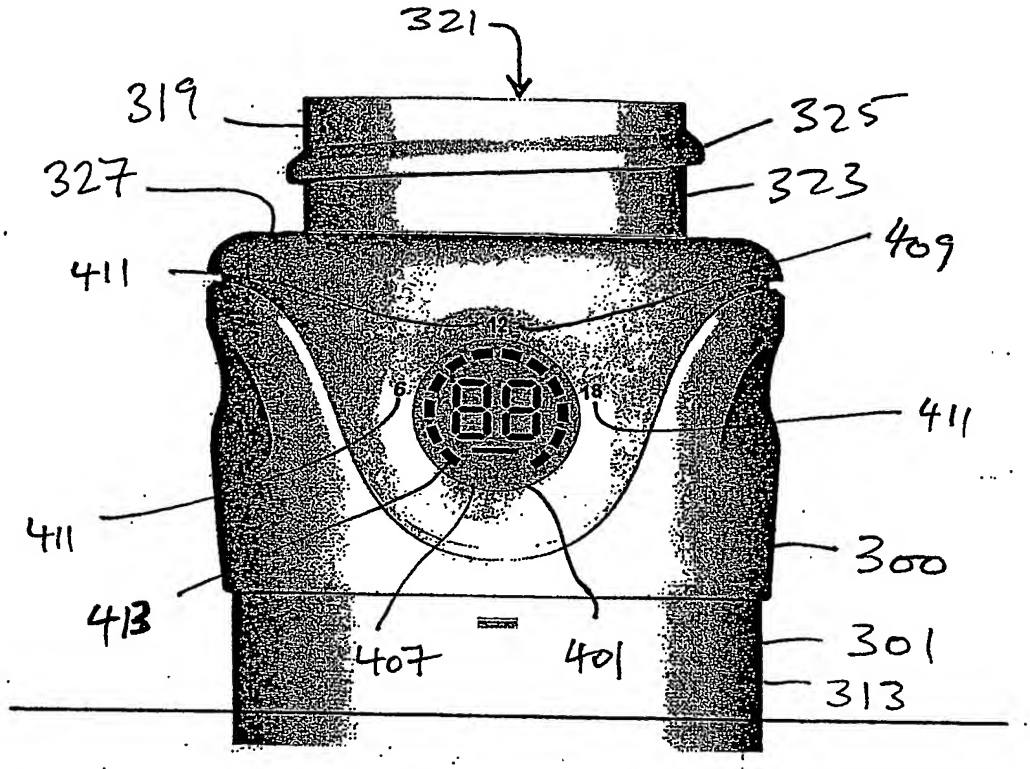
321
319
325
327
323
409
411
411
411
300
413
407
401
301
313

FIG. 4A

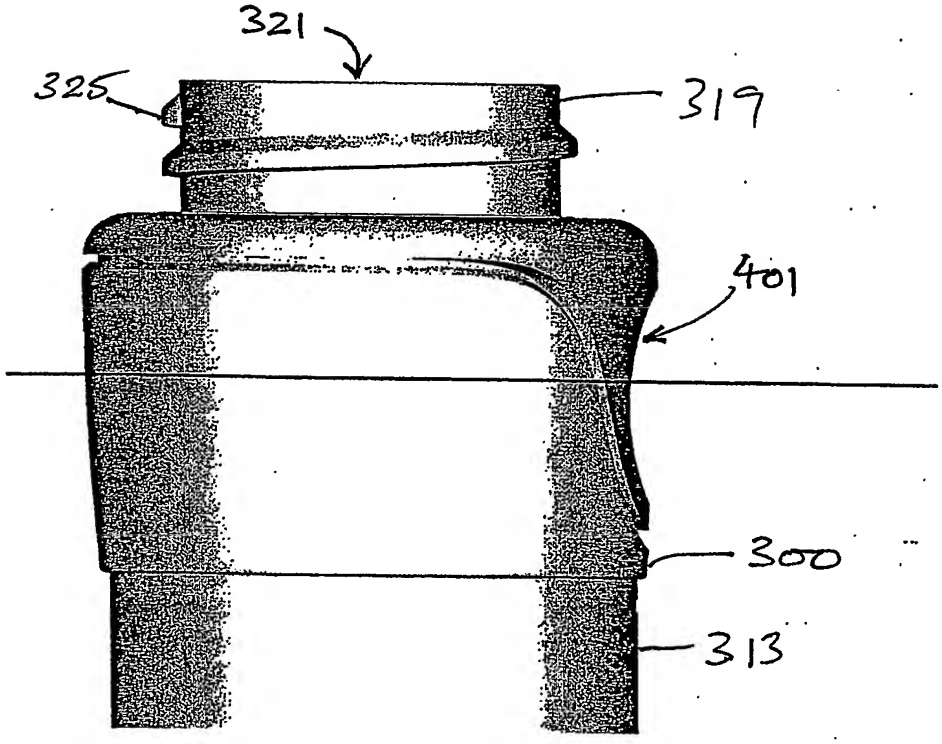
321
325
319
401
300
313

FIG. 4B

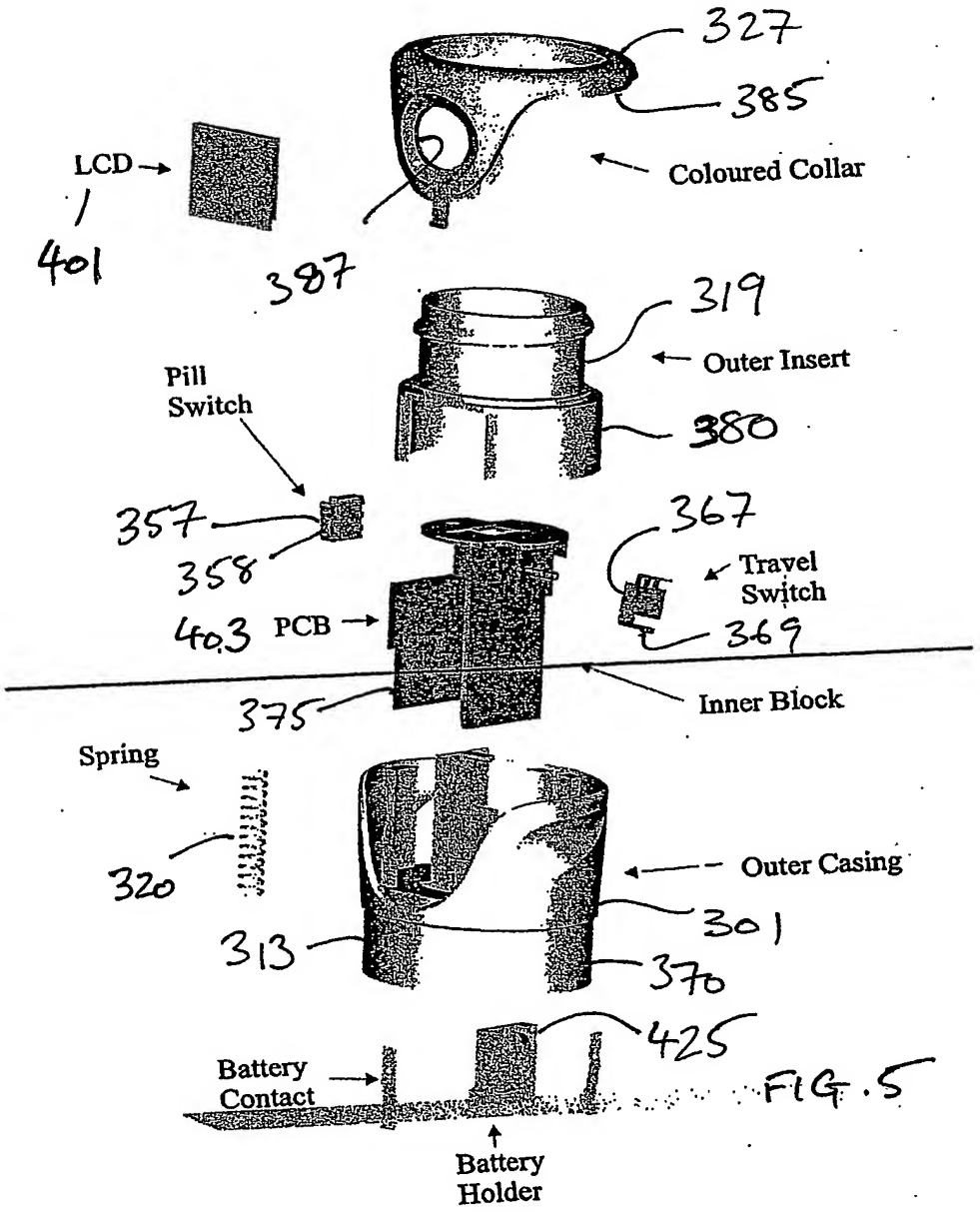
327
385
LCD
Coloured Collar
401
387
319
Outer Insert
Pill
Switch
380
357
367
358
Travel
Switch
403
PCB
369
375
Inner Block
Spring
320
Outer Casing
301
313
370
425
Battery
Contact
Battery
Holder

FIG. 5

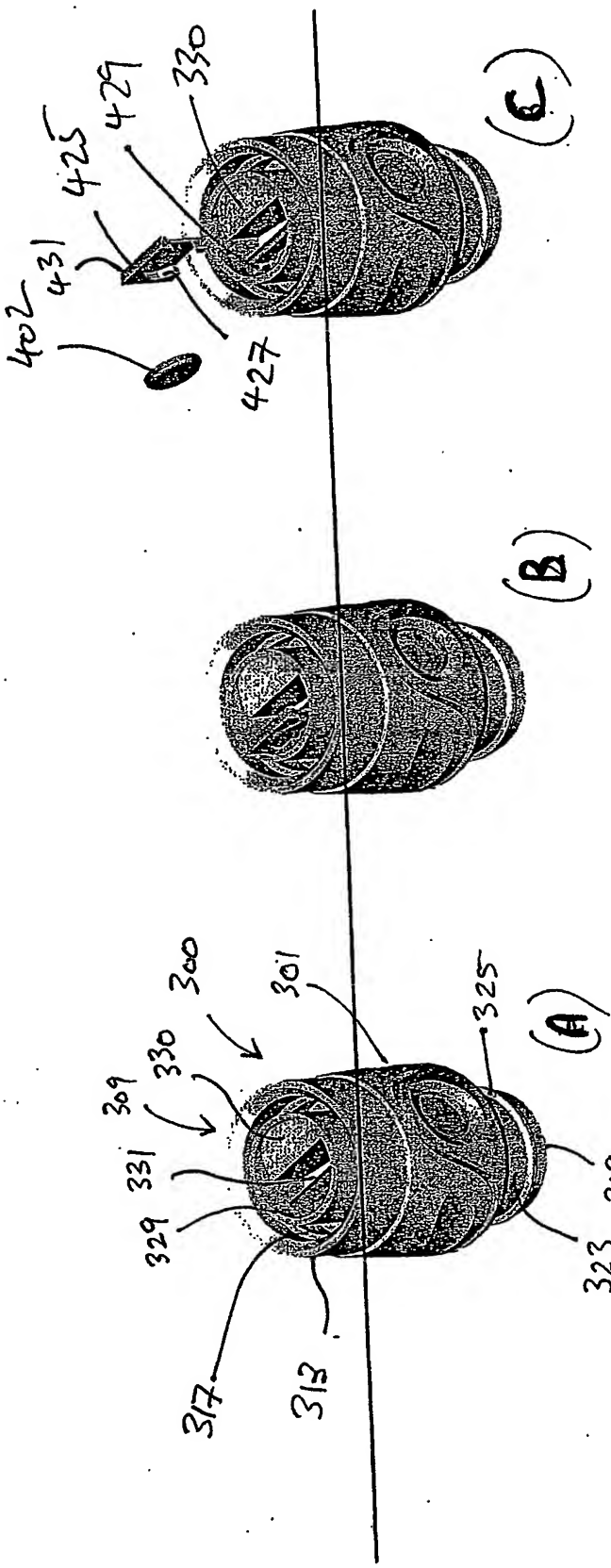
(C)
330
429
425
431
402
427
(B)
(A)
300
301
325
309
330
331
329
319
323
317
313

FIG. 6

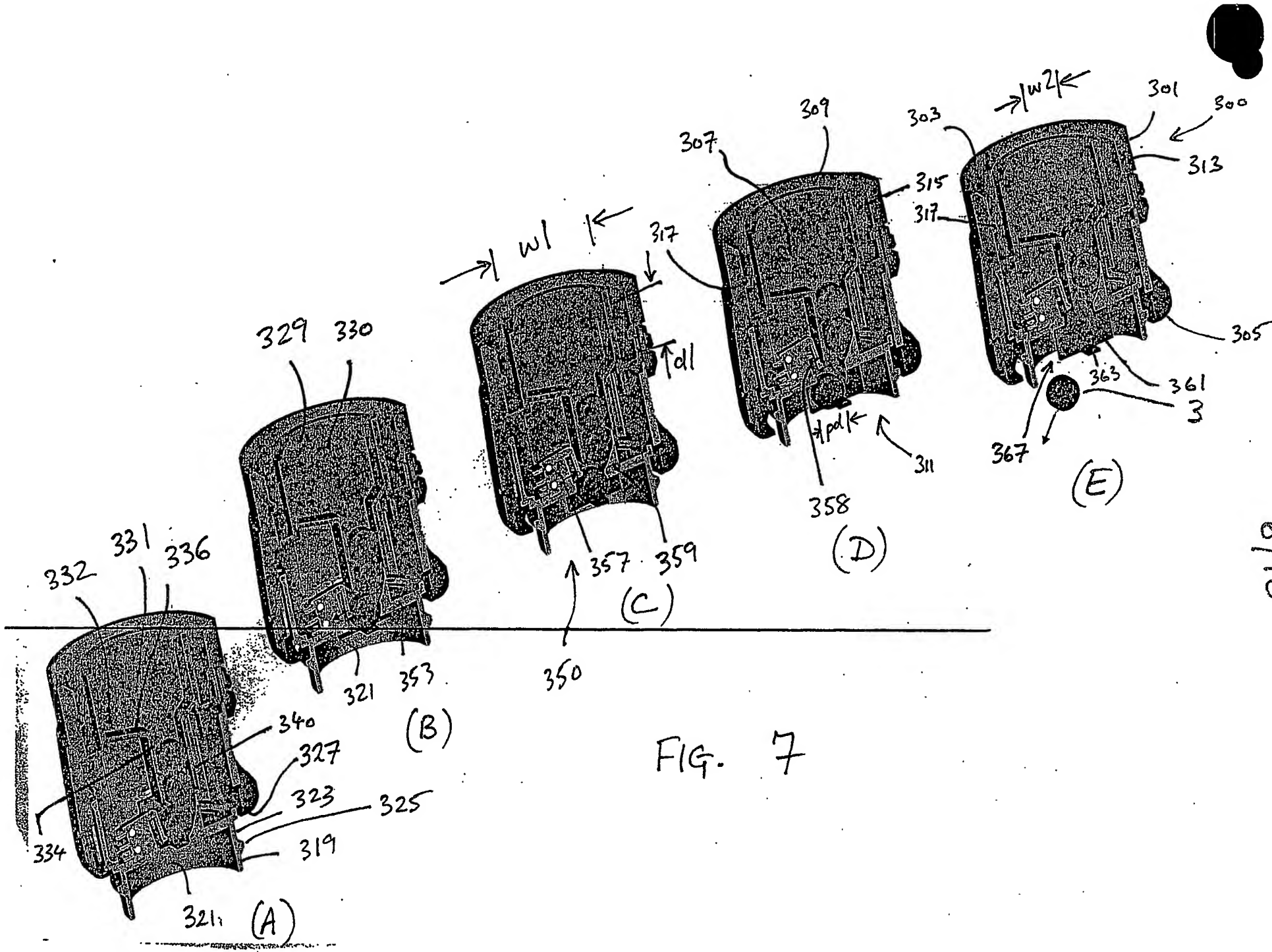
332
331
336
329
330
340
327
323
325
334
319
321
(A)
321
353
(B)
w1
317
dl
357
359
350
(C)
307
309
315
317
pd
311
358
(D)
w2
303
301
300
313
305
363
361
3
367
(E)

FIG. 7

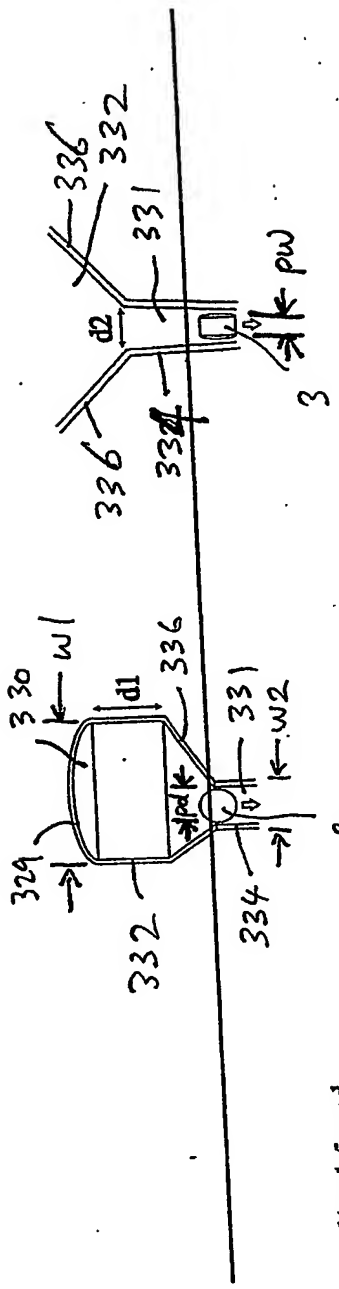

FIG. 9B

FIG. 9A

d1 > 1.5 x pd

d2 < pd
D2 > pw

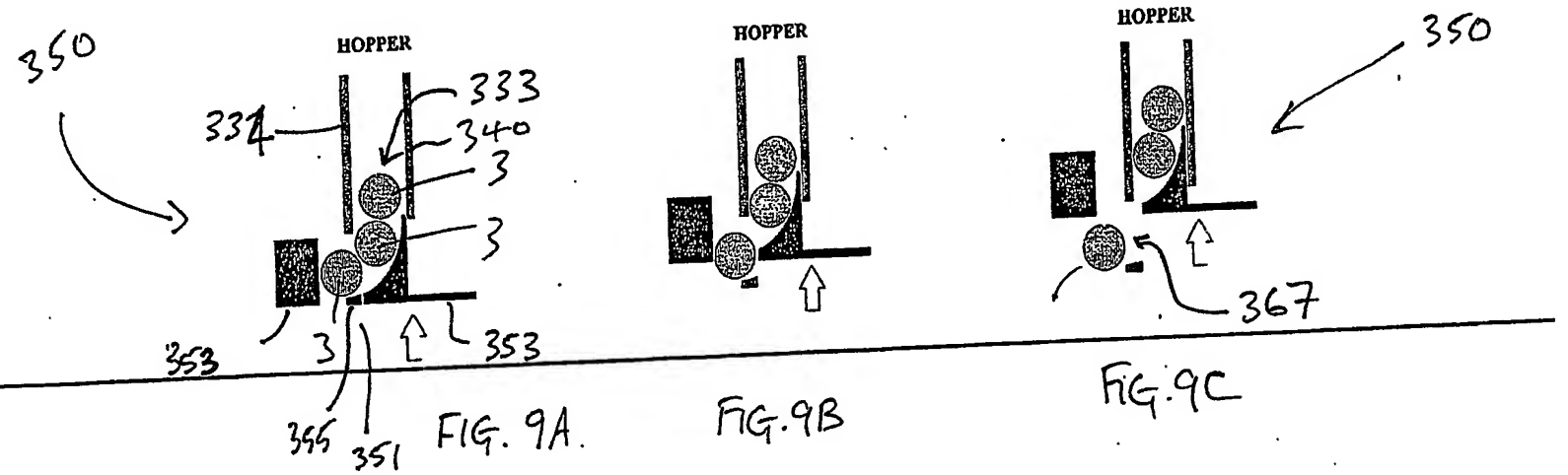

FIG. 9A

FIG. 9B

FIG. 9C

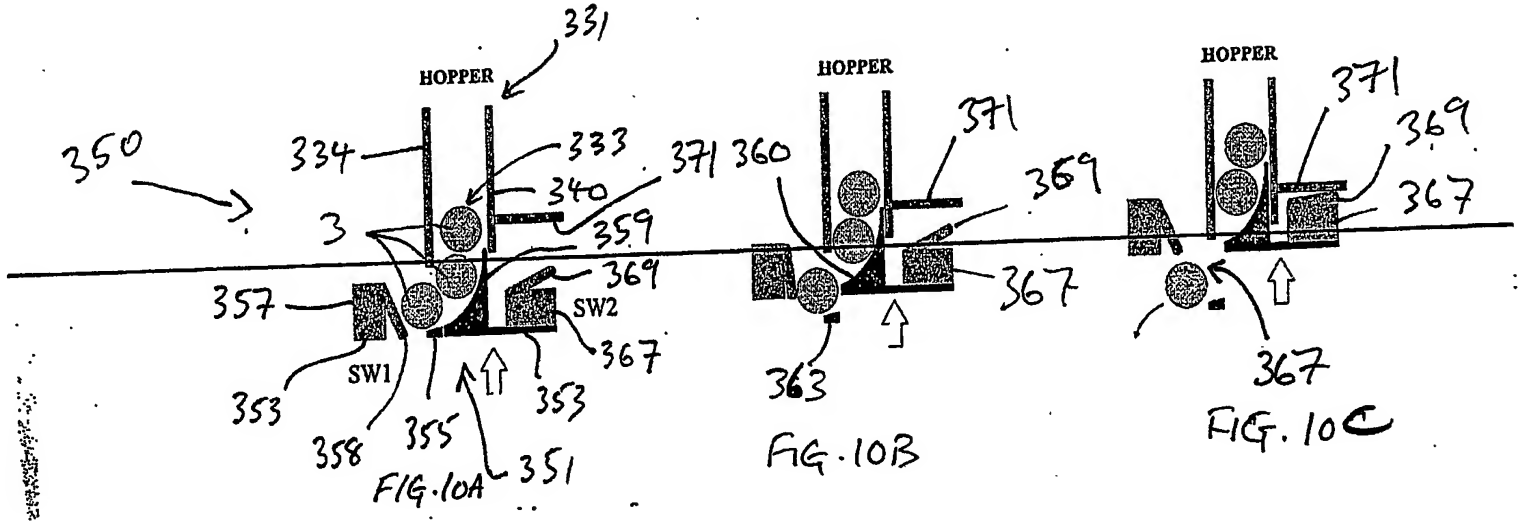

FIG. 10A

FIG. 10B

FIG. 10C

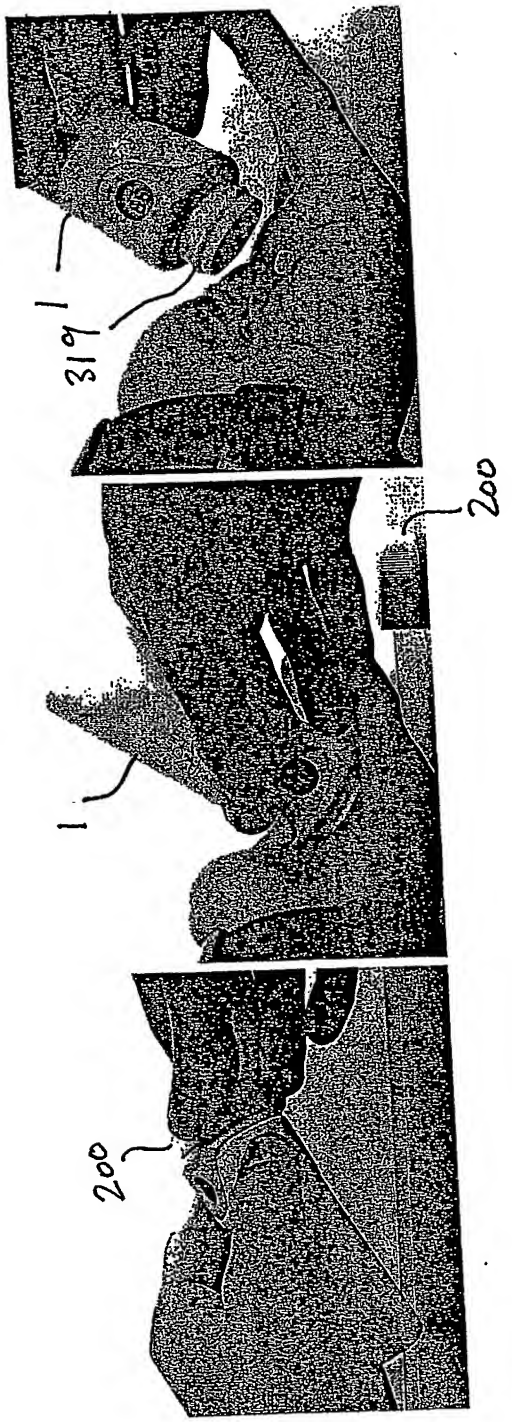

FIG. 11

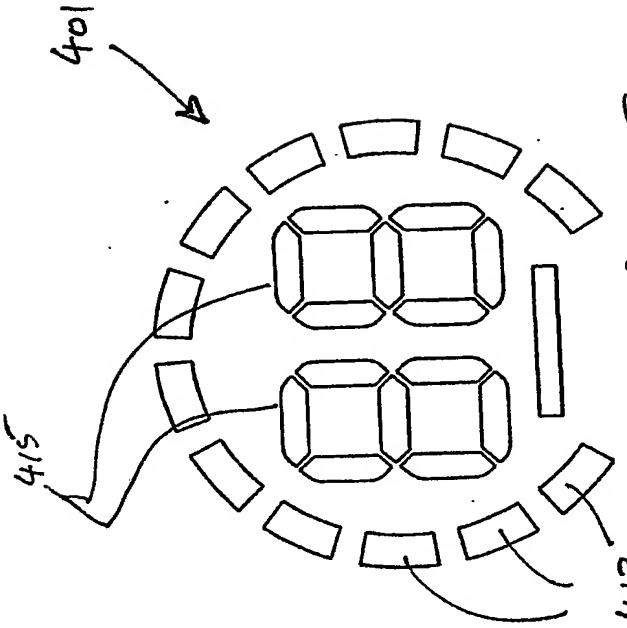

FIG. 12